

ASHRAE GUIDELINE 1-1996 BUILDING COMMISSIONING

ASHRAE RECOMMENDATIONS

CURRENT NAVY PRACTICE

NEEDED NAVY REVISIONS

Owner	Navy	Recommendations
<ol style="list-style-type: none"> 1. Include a statement regarding architect/engineer commissioning responsibilities in request for design services. 2. Develop and commit to the Owner's Program for the facility and its use. 3. Assign operations and maintenance personnel and schedule them to participate in the various meetings, training sessions, and observations/inspections as follows: <ol style="list-style-type: none"> a. Construction-phase coordination meeting. b. Initial owner training session at initial placement of major equipment. c. Maintenance orientation and inspection. d. Piping and ductwork test and flushing verification meetings. e. Procedures meeting for testing, adjusting, and balancing. f. Owner's training session. g. Verification demonstrations. h. Functional performance tests. i. Final review at acceptance meeting. 4. Review and approve any changes made to design intent. 5. Review and approve the construction documents. 6. Provide qualified personnel for videotaping and editing of training sessions. 7. Videotape construction progress. 8. Review and comment on the commissioning authority's verification report. 9. Review and accept the commissioning authority's commissioning report. 	<ol style="list-style-type: none"> 1. Does not address Building Commissioning. 2. Does not develop a complete Building Program, except for Medical Facilities. 3. Claimant & Tenant (C&T) do not control O&M personnel. They are provided by PWC or FSC contract. Not avail. till late in job, if then, and not specifically assigned to one or more individual buildings. 4. Navy may not always obtain C&T approval prior to revisions. 5. C&T signs off on Construction Documents. 6. Navy does not normally Videotape (VT) training. 7. ROICC normally photographs construction progress. 8. C&T usually only sees TABS report as part of OMSI manual, too late to have input. 9. C&T usually only sees TABS report as part of OMSI manual, too late to have input. 	<ol style="list-style-type: none"> 1. Modify CBD, Project Scope, & AE Contract to include. 2. For buildings that are to be commissioned, Claimant, Tenant, & EFD need to develop the detailed room by room requirements: size, vent, temp, lighting, power, utilities, equipment, etc., prior to DD1391 submission to Congress. 3. Regional Commander and PWC should assign O&M personnel to individual buildings during Program development, Design, Construction, & Commissioning. Consider appointing a single-point-of- contact manager for each individual Commissioned building to provide continuity. Manager to have a say in who responds to O & M requests by C&T. 4. C&T will review and approve all changes to Building Program document. 5. No Change. 6. Revise specs to require GC to VT training, ROICC to supervise. 7. ROICC will also VT Construct. Progress. 8. & 9. C&T will review and comment on both CA Verification & Commissioning Reports.

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<p>Commissioning Authority</p> <ol style="list-style-type: none"> 1. Organize and lead the commissioning team. 2. Prepare the initial design intent document from the information contained in the Owner's Program. 3. Prepare a program-phase Commissioning Plan that describes in general the extent of the commissioning process to accomplish the Owner's Program and the initial design intent. 4. Develop the design-phase Commissioning Plan, which details the extent and activities of the commissioning process including commissioning team organization, schedule, training, and documentation requirements and all related testing, verification, and quality control procedures. 5. Review and comment on the impact of the design documents on the HVAC commissioning process for the mechanical, electrical, structural, plumbing, process, interior design, and other design professionals within the commissioning process, so that interfaces between systems are recognized and coordinated. 6. Prepare the construction-phase HVAC Commissioning Plan required as part of the commissioning specification. Include list of all contractors for commissioning events by name, firm, and trade specialty. 7. Execute the HVAC commissioning process through organization of all meetings, tests, demonstrations, training events, and performance verifications described in the contract documents and approved HVAC commissioning process. Organizational responsibilities include preparation of agendas, attendance lists, arrangements for facilities, and timely notification to participants for each commissioning events. The commissioning authority shall act as chair at all commissioning events and ensure execution of all agenda items. The commissioning authority shall prepare minutes of every commissioning event and send copies to all commissioning team members and attendees within five workdays of the event. 	<p>Navy</p> <ol style="list-style-type: none"> 1. EFDLant uses TABS for HVAC Systems, Apparatus Testing for Electrical Systems, Fire Protection Inspection for Fire Suppression and Alarm Systems, and Certified Navy Elevator Inspectors for Vertical Transportation Equipment. Other EFD's use some similar efforts. 2. Not usually done. 3. Not usually done. 4. Not usually done. 5. ROICC usually reviews CD for TABS ability. 6. Not usually done. 7. TABS contractor usually submits a report to the ROICC, but not usually as extensive as required for BC. 	<p>Recommendations</p> <ol style="list-style-type: none"> 1. C&T require and fund Commissioning on all appropriate buildings. 2. CA will fully comply. 3. CA will fully comply. 4. CA will fully comply. 5. CA will fully comply. 6. CA will fully comply. 7. CA will fully comply.

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COMMISSIONING AUTHORITY	Navy	Recommendations
<p>8. Review the plans and specifications with respect to their completeness in all areas relating to the HVAC commissioning process. This includes ensuring that the design phase Commissioning Plan has been followed and that there are adequate devices included in the design to ensure the ability to properly test, balance, and adjust the systems and to document the performance of each piece of equipment and each system. Any items required but not shown shall be brought to the attention of the construction manager prior to submittal of shop drawings.</p> <p>9. Schedule the construction-phase coordination meeting within 90 days of the award of the contract at some convenient location and at a time suitable to the construction manager, the HVAC design professional, and the electrical design professional. This meeting will be for the purpose of reviewing the complete HVAC commissioning process and establishing tentative schedules for mechanical and electrical system orientation and inspections; O&M submittals; training sessions; system flushing and testing; job completion; testing, adjusting, and balancing (TAB) work; and functional performance testing.</p> <p>10. Schedule the initial owner HVAC training session so that it will be held immediately before the mechanical system orientation and inspection. This session will be attended by the owner's O&M personnel, the HVAC design professional, the electrical design professional, the mechanical contractor, the electrical contractor, and the commissioning authority. The HVAC design professional will conduct this session with assistance from the electrical design professional, giving an overview of the system, the system design goals, and the reasoning behind the selection of the equipment.</p> <p>11. Coordinate the HVAC mechanical system orientation and inspection following the initial training session. The mechanical system orientation and inspection will be conducted by the mechanical contractor. The emphasis of this orientation and inspection will be an observation of the equipment location with respect to accessibility. Prepare minutes of this meeting, with separate summaries of deficiency findings by the owner's staff and commissioning authority. Distribute to attendees and the owner.</p>	<p>8. Not usually done.</p> <p>9. Not usually done.</p> <p>10. Not usually done.</p> <p>11. Not usually done.</p>	<p>8. CA will fully comply.</p> <p>9. CA will fully comply.</p> <p>10. CA will fully comply.</p> <p>11. CA will fully comply.</p>

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COMMISSIONING AUTHORITY <p>12. Coordinate the HVAC electrical system orientation and inspection following the HVAC mechanical system orientation and inspection session. The electrical system orientation and inspection will be conducted by the electrical contractor. The emphasis of this orientation and inspection will be an observation of the equipment location with respect to accessibility and function. Prepare minutes of this meeting, with separate summaries of deficiency findings by the owner and commissioning authority. Distribute to attendees and the owner.</p> <p>13. Receive and review the operations and maintenance (O&M) manuals as submitted by the contractor. Ensure that they follow the specified outline and format. Insert systems description as provided by the HVAC design professional in the Systems Manual.</p> <p>14. Check installation for adequate accessibility for maintenance and component replacement or repair.</p> <p>15. Witness equipment, subsystem, and system start-up and testing. Ensure the results are documented, including a summary of deficiencies, and incorporated in the O&M manuals.</p> <p>16. Prior to initiating the TAB work, meet with the owner, mechanical contractor, HVAC design professional, and TAB contractor. The TAB contractor will outline TAB procedures and get concurrence from the HVAC design professional and commissioning authority. Ensure that the TAB contractor has all forms required for proper data collection and understands their importance and use.</p> <p>17. Schedule the O&M training sessions. These training sessions are to be attended by the owner, the commissioning authority, the HVAC design professional, the electrical design professional, the construction manager, contractors, and equipment suppliers as necessary. The format will follow the outline in the O&M manuals. They should include hands-on training.</p> <p>18. Upon receipt of notification from the construction manager that the HVAC system has been completed and is operational and the TAB report has been accepted by the HVAC design professional, proceed to verify the TAB report and the function of the control systems in accordance with the commissioning specification. Prepare a verification report, including all test data and identification of any deficiencies, and submit it to the owner and HVAC design professional for review.</p>	Navy <p>12. Not usually done.</p> <p>13. OMSI review engineer usually reviews the O & M manuals for ROICC approval.</p> <p>14. Not usually done.</p> <p>15. Not usually done.</p> <p>16. Not usually done.</p> <p>17. Not usually done.</p> <p>18. Not usually done.</p>	Recommendations <p>12. CA will fully comply.</p> <p>13. CA will fully comply.</p> <p>14. CA will fully comply.</p> <p>15. CA will fully comply.</p> <p>16. CA will fully comply.</p> <p>17. CA will fully comply.</p> <p>18. CA will fully comply.</p>

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<p>COMMISSIONING AUTHORITY</p> <ol style="list-style-type: none"> 19. Supervise the commissioning team members in the functional performance tests. The test data will be part of the commissioning report. 20. Review as-built drawings for accuracy with respect to the installed systems. Request revisions to achieve accuracy. 21. Ensure that the O&M manuals and all other as-built records have been updated to include all modifications made during the construction phase. 22. Prepare the Systems Manual. 23. Repeat functional performance tests to accommodate seasonal tests and/or correct any performance deficiencies. Revise and resubmit the Commissioning Report. 24. Prepare the final Commissioning Report. 25. Assemble the final documentation, which will include the Commissioning Report, the Systems Manual, and all as-built records. Submit this documentation to the owner for review and acceptance. 26. Recommend acceptance of the HVAC system to the owner. 	<p>Navy</p> <ol style="list-style-type: none"> 19. Not usually done. 20. Usually done by Design Engineer for ROICC approval. 21. OMSI review engineer usually reviews the O & M manuals for ROICC approval. 22. Not usually done. 23. Not usually done. 24. Not usually done. 25. Usually done for OMSI manual, without Commissioning Report. 26. ROICC usually does this. 	<p>Recommendations</p> <ol style="list-style-type: none"> 19. CA will fully comply. 20. CA will fully comply. 21. CA will fully comply. 22. CA will fully comply. 23. CA will fully comply. 24. CA will fully comply. 25. CA will fully comply. 26. CA will fully comply.

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Architect <ol style="list-style-type: none">1. Provide adequate support to the design professionals who must provide a service as a part of the commissioning process. This includes providing information to produce the basis of design and adequate space for equipment installation and maintenance.2. Include a statement regarding commissioning in Division 1 - General Requirements, alerting all parties to the need to participate.3. Select construction and finish materials that minimize adverse effects on indoor air quality (IAQ).	Navy <ol style="list-style-type: none">1. Support not always provided. Basis of Design often incomplete. Space often inadequate for both installation and maintenance2. Not usually done.3. Not usually done.	Recommendations <ol style="list-style-type: none">1. AE will provide adequate support.2. AE will include the statement in Div. I.3. AE will comply.

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HVAC Design Professional <ol style="list-style-type: none"> 1. Provide documentation of basis of design and initial design concepts. 2. Provide HVAC system design parameters and revisions to the initial design intent document as necessary, obtaining approval of the owner. 3. Prepare contract documents, including the commissioning specification and description of the HVAC system. 4. Prepare contract documents that coordinate interfaces between life safety systems and HVAC systems, including commissioning specifications. 5. Attend construction-phase coordination meeting to be scheduled by the commissioning authority within 90 days of the award of contract. 6. Specify and verify adequate maintenance accessibility for each piece of equipment in shop drawings and actual installation. Periodic inspections are part of the HVAC design professional's construction administration duties. 7. Develop an overview of system design and operation concepts for the Systems Manual. 8. Conduct the HVAC training session on the overview of the system design, the system design goals, and the reasoning behind the selection of equipment. Provide detailed training for complex installations. 9. Participate in O&M personnel orientation, inspection, and training at the final construction stage. 10. Review TAB procedures submitted by TAB contractor. 11. Attend initial meeting with TAB contractor scheduled by commissioning authority. 12. Attend the classroom portion of the owner training sessions. Attendance at the hands-on demonstration is optional. 13. Review verification and functional performance testing procedures submitted by the testing contractor. 14. Review TAB report and verification data sheets for system conformance to contract documents. Issue a report noting deficiencies requiring correction to the construction manager. Review and accept the final TAB report. 	Navy <ol style="list-style-type: none"> 1. Usually partially done, to provide information to the Design reviewer at 35%. Not usually made available to the Contractor or the ROICC. 2. Not usually done formally. 3. Done, but not including commissioning specification and HVAC system description. 4. Done, but not including commissioning specification. 5. Not usually done. 6. Usually partially done. 7. Usually done for OMSI manual, but not available to Contractor & ROICC during construction. 8. Not usually done. 9. Not usually done. 10. Usually done. 11. Not usually done. 12. Not usually done. 13. Not usually done. 14. Usually done. 	Recommendations <ol style="list-style-type: none"> 1. HVAC Design Professional (DP) will fully comply. 2. HVAC Design Professional (DP) will fully comply. 3. HVAC Design Professional (DP) will fully comply. 4. HVAC Design Professional (DP) will fully comply. 5. HVAC Design Professional (DP) will fully comply. 6. HVAC Design Professional (DP) will fully comply. 7. HVAC Design Professional (DP) will fully comply, providing the documents to the GC and ROICC in addition to including in the OMSI documents. 8. HVAC Design Professional (DP) will fully comply. 9. HVAC Design Professional (DP) will fully comply. 10. HVAC Design Professional (DP) will fully comply. 11. HVAC Design Professional (DP) will fully comply. 12. HVAC Design Professional (DP) will fully comply. 13. HVAC Design Professional (DP) will fully comply. 14. HVAC Design Professional (DP) will fully comply.

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<p>HVAC Design Professional</p> <ol style="list-style-type: none"> 15. Review verification data sheets for system conformance to contract documents. Issue a report noting deficiencies requiring correction to the construction manager. 16. Review and comment on the commissioning authority's verification report. Issue a report, if necessary, noting any additional deficiencies requiring correction to the construction manager. Once satisfied with the completion of verification, issue the Certificate of Readiness allowing functional performance testing to begin. 17. Review testing contractor's functional performance testing report for system conformance to contract documents. Issue a report noting deficiencies requiring correction to the construction manager. Review testing contractor's functional performance testing report for deficiencies in meeting the finalized design intent. Issue a report noting deficiencies to the owner. 18. Review and accept as-built records as required by contract documents and turn them over to the commissioning authority. 19. Review and comment on the final commissioning documentation. 20. Be responsible for system evaluation, adequacy of the system to meet design intent, capacity of the system, quality control checks, or any of the other elements of the system design and recommend final acceptance of the HVAC system to the owner. 	<p>Navy</p> <ol style="list-style-type: none"> 15. Not usually done. 16. Not usually done. 17. Not usually done. 18. Usually done, turned over to ROICC, 19. Not usually done. 20. Usually only partially done. 	<p>Recommendations</p> <ol style="list-style-type: none"> 15. HVAC Design Professional (DP) will fully comply. 16. HVAC Design Professional (DP) will fully comply. 17. HVAC Design Professional (DP) will fully comply. 18. HVAC Design Professional (DP) will fully comply. 19. HVAC Design Professional (DP) will fully comply. 20. HVAC Design Professional (DP) will fully comply.

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Electrical Design Professional	Navy	Recommendations
<ol style="list-style-type: none"> 1. Provide documentation or design narratives for electrical services to be provided for specific mechanical equipment requirements. This information should be included in the Systems Manual. 2. Provide electrical system information confirming compatibility with electrical service requirements specified by the mechanical design professional for all HVAC equipment and systems. Provide information necessary for the basis of design. 3. Prepare contract documents that coordinate interfaces between life safety systems and HVAC systems including commissioning specifications. 4. Attend construction-phase coordination meeting scheduled by the commissioning authority. 5. Participate in the start-up of HVAC equipment and systems. 6. Participate in the HVAC training sessions as required. 7. Participate in review of shop drawings for mechanical equipment. 8. Prepare electrical ladder wiring diagrams indicating power source connections to HVAC equipment and systems and interrelationships between life safety systems and HVAC systems and equipment, including a review of the automatic control and/or building automation system. 9. Prepare as-built electrical service record drawings as required by contract documents. 10. Verify that any space requirements for electrical equipment are in accordance with relevant code requirements. 11. Participate in O&M personnel orientation and inspection sessions. 	<ol style="list-style-type: none"> 1. Not usually done. 2. Not usually done. 3. Usually done. 4. Not usually done. 5. Not usually done. 6. Not usually done. 7. Not usually done. 8. Not usually done. One-line diagrams are usual. 9. Usually done. 10. Usually done. 11. Not usually done. 	<ol style="list-style-type: none"> 1. Electrical Design Professional will fully comply. 2. Electrical Design Professional will fully comply. 3. Electrical Design Professional will fully comply. 4. Electrical Design Professional will fully comply. 5. Electrical Design Professional will fully comply. 6. Electrical Design Professional will fully comply. 7. Electrical Design Professional will fully comply. 8. Electrical Design Professional will fully comply. 9. Electrical Design Professional will fully comply. 10. Electrical Design Professional will fully comply. 11. Electrical Design Professional will fully comply.

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Construction Manager <ol style="list-style-type: none"> 1. Include costs for commissioning requirements in the contract price. 2. Include commissioning requirements in all contractors' contracts to ensure full cooperation of all parties in the HVAC commissioning process. 3. Provide adequate accessibility to all installed HVAC equipment for maintenance and component replacement or repair. 4. Ensure acceptable representation with the means and authority to prepare and coordinate execution of the HVAC commissioning process as described in the contract documents. 5. Issue a statement that certifies all work has been completed, including control systems calibrated and operational, in accordance with contract documents. 6. Issue a statement that TAB work has been completed, and submit the final TAB reports to the HVAC design professional for review and acceptance. 7. Remedy deficiencies identified in verification tests. 8. Evaluate any performance deficiencies identified in the FPT report for nonconformance with construction documents. 9. Review final commissioning documentation. 	Navy <ol style="list-style-type: none"> 1. ROICC performs role of Construction Manager. SIOH does not fund Commissioning requirements. 2. Commissioning not currently required. 3. Designer responsible to indicate space requirements on construction drawings. ROICC responsible to insure Contractor provides the space. 4. ROICC insures that TABS is done in EFDLant AOR. 5. Not done as a separate item. 6. Done. 7. Not done as a separate item. 8. Not done. 9. Not done. 	Recommendations <ol style="list-style-type: none"> 1. Provide additional funds to support ROICC during the additional Commissioning effort. 2. Designer will include the commissioning requirements in the construction documents for all parties under contract. 3. ROICC will increase vigilance on equipment install and maintain space requirements. 4. ROICC will comply. 5. ROICC will comply. 6. ROICC will continue doing. 7. ROICC will comply. 8. ROICC will comply. 9. ROICC will comply.

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<p>Mechanical Contractor</p> <ol style="list-style-type: none"> 1. Include costs for commissioning requirements in the contract price. 2. Include requirements for submittal data, O&M data, and O&M training in each purchase order or subcontract written. 3. Ensure cooperation and participation of specialty sub-contractors, such as sheet metal, piping, refrigeration, water treatment, TAB, and controls contractors. 4. Ensure coordination, installation, and operation of interfaces between life safety and HVAC systems. 5. Ensure participation of major equipment manufacturers in appropriate training and testing activities. 6. Attend construction-phase coordination meeting scheduled by the commissioning authority. Prepare necessary preliminary schedule for mechanical system orientation and inspections, O&M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, TAB, and task completion for use by the commissioning authority. Update schedule as appropriate throughout the construction period. 7. Attend initial training session, and conduct mechanical system orientation and inspection at the equipment placement completion stage. Update drawings to record condition to date, and review with the commissioning authority. 8. Gather O&M data on all equipment and assemble in binders as required by the commissioning specification. Submit to commissioning authority prior to the completion of construction. 9. Notify the commissioning authority when equipment and system start-up and testing can be witnessed. 	<p>Navy</p> <ol style="list-style-type: none"> 1. Cost for TABS is currently included to EFDLant AOR. 2. Done now. 3. Down now for TABS. 4. Usually done now. 5. Occasionally done now. 6. Not usually done now. 7. Not usually done now. 8. Usually done now, submitted to OMSI preparer. 9. Not usually done now. 	<p>Recommendations</p> <ol style="list-style-type: none"> 1. Designer will include Commissioning requirements in the construction documents (CD), and therefore Contractor will include costs in his contract price. 2. Continue doing. 3. CD will include for other than TABS. 4. ROICC will insure done fully. 5. CD will include additional requirements. 6. ROICC will insure done fully. 7. CD will include additional requirements. 8. CD will include additional requirements. 9. CD will include additional requirements.

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<p>Mechanical Contractor</p> <ol style="list-style-type: none"> 10. Notify the commissioning authority of the time for start of the TAB work. Attend the initial TAB meeting for review of the TAB procedures. 11. Participate in, and schedule equipment suppliers and contractors to participate in, the training sessions as set up by the commissioning authority. 12. Conduct a mechanical system orientation and inspection with hands-on training. Update drawings to record condition to date, and review with the commissioning authority prior to the orientation. 13. Provide written notification to the construction manager and commissioning authority that the following work has been completed in accordance with the contract documents and that the equipment, systems, and subsystems are functioning as required. <ol style="list-style-type: none"> a. HVAC equipment, including all fans, air-handling units, dehumidification units, ductwork, dampers, terminals, and all Division 15 equipment. b. Refrigeration equipment, pumping systems, and heat rejection equipment. c. Boilers, pumping systems, and fuel supply systems. d. Fire stopping in the fire-rated construction, including fire and smoke damper installation, caulking, gasketing, and sealing of smoke barriers. e. Dedicated smoke control systems, including stairway pressurization and atrium systems. f. Nondedicated systems using the air-handling units for smoke control. g. Fire detection and smoke detection devices furnished under other divisions of this specification as they affect the operation of the smoke control systems. h. That building control systems are functioning to control HVAC equipment and smoke control systems. 14. Demonstrate the operation of each piece of equipment to the commissioning authority. Schedule subcontractors as may apply to demonstrate the operation of the equipment and systems. 15. Provide services of an engineer to participate in verification tests. 16. Turn over set of as-built records to the commissioning authority. 	<p>Navy</p> <ol style="list-style-type: none"> 10. Not usually done now. 11. Not usually done now. 12. Not usually done now. 13. Not usually done now. 14. Usually done now. 15. Not usually done now. 16. Usually done now, turned over to ROICC. 	<p>Recommendations</p> <ol style="list-style-type: none"> 10. CD will include additional requirements. 11. CD will include additional requirements. 12. CD will include additional requirements. 13. CD will include additional requirements. 14. CD will continue to require. 15. CD will include additional requirements. 16. CD will continue to require.

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<p>Testing, Adjusting, and Balancing Contractor</p> <ol style="list-style-type: none"> 1. Include costs for commissioning requirements in the contract price. 2. Attend initial commissioning coordination meeting scheduled by the commissioning authority. 3. Submit the TAB procedures for review and acceptance by the HVAC design professional. 4. Attend the TAB review meeting scheduled by the commissioning authority. Be prepared to discuss the TAB procedures that will be followed in testing, adjusting, and balancing the HVAC system. 5. Participate in training sessions as scheduled by the commissioning authority. 6. At the completion of the TAB work and submittal of final TAB report, notify the mechanical contractor and demonstrate to the commissioning authority the performance of the equipment covered by the TAB contract as detailed in the commissioning specification. 7. Participate in verification of the TAB report and repeat any measurement contained in the TAB report where required by the commissioning authority for verification or diagnostic purposes. 	<p>Navy</p> <ol style="list-style-type: none"> 1. Usually done now in EFDLant AOR. 2. Usually attends similar meeting for TABS. 3. Usually submits to ROICC, for review. 4. Not usually done. 5. Not usually done. 6. Not usually done. 7. Usually done now in EFDLant AOR. 	<p>Recommendations</p> <ol style="list-style-type: none"> 1. CD will include additional requirements. 2. CD will include additional requirements. 3. CD will include additional requirements. 4. CD will include additional requirements. 5. CD will include additional requirements. 6. CD will include additional requirements. 7. CD will include additional requirements.

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<p>Automatic Controls and Building Automation System Contractors</p> <ol style="list-style-type: none"> 1. Include costs for commissioning requirements in the contract price. 2. Provide submittals, as-built documents, and appropriate O&M manual section(s). 3. Attend commissioning coordination meetings scheduled by the commissioning authority as appropriate. 4. Participate in training sessions as scheduled by the commissioning authority. 5. At the completion of automatic controls and building automation systems' start-adjustment work, notify the mechanical contractor and demonstrate the performance of the automatic controls and building automation systems to the commissioning authority. 6. Provide services of a controls engineer to participate in verification tests and FPT. 	<p>Navy</p> <ol style="list-style-type: none"> 1. Not usually done. 2. Usually done. 3. Not usually done. 4. Usually done. 5. Not usually done, except in EFDLant. 6. Not usually done. 	<p>Recommendations</p> <ol style="list-style-type: none"> 1. CD will include additional requirements. 2. CD will continue to require. 3. CD will include additional requirements. 4. CD will continue to require. 5. CD will include additional requirements. 6. CD will include additional requirements.

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Electrical Contractor <ol style="list-style-type: none"> 1. Include costs for commissioning requirements in the contract price. 2. Include requirements for submittal data, O&M data, and O&M training in each purchase order or subcontract written. 3. Enlist the support of the construction manager to ensure cooperation of other subcontractors such as the automatic controls and building automation systems contractor, fire detection, and security as necessary. 4. Ensure participation of major equipment manufacturers through their representatives. 5. Ensure coordination, installation, and operation interfaces between life safety and HVAC systems. 6. Attend construction-phase coordination meeting scheduled by the commissioning authority. Prepare necessary preliminary schedule for O&M personnel orientation and inspections, O&M manual submission, training sessions, equipment start-up, testing and adjusting, and job completion for use by the commissioning authority. Update schedule as appropriate throughout the construction period. 7. Attend initial training session and conduct the electrical system orientation and inspection at the equipment placement completion stage. Update drawings to record condition to date, and review with the commissioning authority. 8. Gather O&M data on all equipment and assemble in binders as required by the commissioning specification. Submit to commissioning authority prior to the completion of construction. , 	Navy <ol style="list-style-type: none"> 1. Not usually done. 2. Usually done. 3. Usually done by the ROICC. 4. Not usually done. 5. Usually done. 6. Not usually done. 7. Usually provides training and as-builts. 8. Usually provides OMSI data to ROICC. 	Recommendations <ol style="list-style-type: none"> 1. CD will include additional requirements. 2. CD will continue to require. 3. CD will continue to require. 4. CD will include additional requirements. 5. CD will continue to require. 6. CD will include additional requirements. 7. CD will continue to require, with additional requirements. 8. CD will continue to require, with additional requirements.

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<p>Electrical Contractor</p> <ol style="list-style-type: none"> 9. Notify the commissioning authority of the time for each required test. 10. Participate in and schedule equipment suppliers and contractors to participate in the training sessions as set up by the commissioning authority. 11. Conduct a maintenance orientation and inspection with hands-on training. Update drawings to record condition to date and review with the commissioning authority prior to the orientation. 12. Provide written certification to the construction manager and the commissioning authority that the work has been completed in accordance with the plans and specifications and that it is functioning as designed. Where the work has been subcontracted, the contractor shall be responsible for the initial certification, with the electrical contractor certifying that he/she has inspected the work and that it has been completed and is functioning as designed. This certification must be submitted to the commissioning authority prior to the final verification. 13. Demonstrate the operation of each piece of equipment to the commissioning authority. Schedule subcontractors as they apply to demonstrate the operation of the equipment and systems. 14. Turn over set of record mark-up drawings to the electrical design professional for final incorporation into record documents. 	<p>Navy</p> <ol style="list-style-type: none"> 9. Not usually done now. 10. Not usually done now. 11. Not usually done now. 12. Not usually done now. 13. Usually done now. 14. Usually done now, turned over to ROICC. 	<p>Recommendations</p> <ol style="list-style-type: none"> 9. CD will include additional requirements. 10. CD will include additional requirements. 11. CD will include additional requirements. 12. CD will include additional requirements. 13. CD will continue to require. 14. CD will continue to require.

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<p>Testing Contractor</p> <ol style="list-style-type: none"> 1. Provide services of an experienced testing technician. 2. Provide detailed checklist data sheets to document verification tests. 3. Submit detailed verification test procedures and data sheets for review by the HVAC design professional. 4. Submit detailed FPT procedures for review and acceptance by the commissioning authority. 5. Submit detailed list of test instrumentation with appropriate calibration records to be utilized for verification and FPT. Record data as necessary. 6. Conduct verification tests. 7. Submit verification test data to the HVAC design professional and commissioning authority for review. 8. Conduct FPT, including opposite season tests, as required. 9. Submit FPT report to the commissioning authority for review and acceptance. 10. Retest if performance deficiencies are found and corrected and additional testing is requested. 	<p>Navy</p> <ol style="list-style-type: none"> 1. Not usually done now. 2. Not usually done now. 3. Not usually done now. 4. Not usually done now. 5. Not usually done now. 6. Not usually done now. 7. Not usually done now. 8. Not usually done now. 9. Not usually done now. 10. Not usually done now. 	<p>Recommendations</p> <ol style="list-style-type: none"> 1. CD will include additional requirements. 2. CD will include additional requirements. 3. CD will include additional requirements. 4. CD will include additional requirements. 5. CD will include additional requirements. 6. CD will include additional requirements. 7. CD will include additional requirements. 8. CD will include additional requirements. 9. CD will include additional requirements. 10. CD will include additional requirements.

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ASHRAE RECOMMENDATIONS	CURRENT NAVY PRACTICE	NEEDED NAVY REVISIONS
<p>Equipment Suppliers and Miscellaneous Contractors</p> <ol style="list-style-type: none"> 1. Include costs for commissioning requirements in the contract price. 2. Provide submittals and appropriate O&M manual section(s). 3. Attend initial commissioning coordination meeting scheduled by the commissioning authority. 4. Participate in training sessions as scheduled by the commissioning authority. 5. Demonstrate operation and performance of equipment as applicable. 	<p>Navy</p> <ol style="list-style-type: none"> 1. Not usually done now. 2. Usually done now. 3. Not usually done now. 4. Not usually done now. 5. Not usually done now. <p>Abbreviations used:</p> <p>AE = Architect and Engineer AOR = Area of Responsibility BC = Building Commissioning CA = Commissioning Authority CD = Construction Documents C&T = Claimant and Tenant EFD = Engineering Field Division FSC = Facilities Service Contract GC = General Contractor HVAC = Heating , Ventilation, and Air Conditioning OMSI = Operating and Maintenance Support Information O&M = Operation and Maintenance PWC = Public Works Center ROICC = Resident Officer in Charge of Construction SIOH = Supervision, Inspection, and Overhead TABS = Test and Balance System TBC = Total Building Commissioning VT = Video Tape</p>	<p>Recommendations</p> <ol style="list-style-type: none"> 1. CD will include additional requirements. 2. CD will continue to require. 3. CD will include additional requirements. 4. CD will include additional requirements. 5. CD will include additional requirements.